CLAIMS

1. A deposition method comprising microwave excitation of a component within a reaction chamber during deposition of a material over a substrate within the reaction chamber; the excitation resulting from phased array microwave radiation passing into the reaction chamber.

2. The method of claim 1 further comprising:

flowing a precursor into the reaction chamber; and

reacting the precursor with the microwave excited component to form the material.

3. The method of claim 2 wherein the precursor bonds to the substrate and thereafter reacts with the microwave excited component to form the material deposited on the substrate.

4. The method of claim 2 wherein the precursor reacts with the microwave excited component to form the material which thereafter accumulates on the substrate.

5. The method of claim 1 wherein the component is associated with a surface of the substrate during the microwave excitation.

6. The method of claim 1 wherein the component is not on a surface of the substrate during the microwave excitation.

7. The method of claim 1 wherein the microwave excited component is part of a plasma within the reaction chamber.

8. The method of claim 1 wherein the microwave excited component is selected from the group consisting of H, O and N.

9. The method of claim 1 wherein the material deposited over the substrate comprises a product which includes at least a portion of the microwave excited component.

10. The method of claim 1 wherein the material deposited over the substrate does not comprise the microwave excited component.

11. The method of claim 1 wherein the deposition method is a chemical vapor deposition method.

12. The method of claim 1 wherein the deposition method is an atomic layer deposition method.

13. The method of claim 1 wherein the deposition method is an atomic layer deposition method, the method further comprising:

sequentially pulsing first and second components into the reaction chamber and purging the components from the reaction chamber between the sequential pulses; the microwave excited component being at least one of the first and second components; and

the microwave excitation resulting from pulses of microwave radiation into the chamber; the pulses of microwave radiation substantially coinciding with the pulses of one or both of the first and second components into the reaction chamber.

14. A deposition method, comprising:

providing an apparatus comprising a reaction chamber and a microwave source external to the chamber; the reaction chamber comprising a window through which microwave radiation can pass;

passing microwaves from the source, through the window, and into the chamber;

placing a substrate within the reaction chamber;

flowing one or more materials within the reaction chamber and through the microwaves; and

depositing at least a component of the one or more materials onto the substrate.

15. The method of claim 14 wherein the microwave radiation is associated with a beam that is emitted along a first axis into the chamber and swept along a second axis within the chamber.

16. The method of claim 14 wherein the microwave radiation is associated with a beam that is emitted along a first axis into the chamber and swept along a second axis within the chamber, the second axis being a linear axis.

17. The method of claim 14 wherein the microwave radiation is associated with a beam that is emitted along a first axis into the chamber and swept along a second axis within the chamber, the second axis being a rotational axis.

18. The method of claim 14 wherein the window comprises quartz, mica or plastic.

19. The method of claim 14 wherein the microwave source passes a phased array of microwaves through the window and into the chamber.

20. The method of claim 14 wherein the substrate is a semiconductor substrate.

21. The method of claim 14 wherein the depositing comprises chemical vapor deposition.

22. The method of claim 14 wherein the depositing comprises atomic layer deposition.

23. The method of claim 14 wherein the materials flowed through the microwaves comprise a metal-containing material and oxygen, and wherein the depositing forms an oxide of the metal over the substrate.

24. The method of claim 14 wherein the materials flowed through the microwaves comprise a metal-containing material and nitrogen, and wherein the depositing forms an nitride of the metal over the substrate.

25. The method of claim 14 wherein the materials flowed through the microwaves comprise a metal-containing material and hydrogen, and wherein the depositing forms a film comprising the metal of the metal-containing material over the substrate.

26. The method of claim 14 wherein the materials flowed through the microwaves comprise a titanium-containing material and oxygen, and wherein the depositing forms titanium oxide over the substrate.

27. The method of claim 14 wherein the materials flowed through the microwaves comprise a titanium-containing material and nitrogen, and wherein the depositing forms titanium nitride over the substrate.

28. A deposition method, comprising:

providing an apparatus comprising a reaction chamber and a microwave source external to the chamber; the reaction chamber comprising a window through which microwave radiation can pass;

placing a substrate within the reaction chamber;

flowing one or more one microwave-inducible constituents into the reaction chamber;

flowing one or more precursors into the reaction chamber;

while the substrate and the one or more microwave-inducible constituents are within the reaction chamber, activating at least one of the microwave-inducible constituents with microwave radiation to form at least one activated species;

depositing at least a component of at least one of the one or more precursors onto the substrate; and

reacting the at least one of the one or more precursors with the activated species, the reacting occurring at one or more of before, after and during the depositing.

29. The method of claim 28 wherein the reacting occurs before the depositing.

30. The method of claim 28 wherein the reacting occurs after the depositing.

31. The method of claim 28 wherein the reacting occurs during the depositing.

32. The method of claim 28 wherein the window comprises quartz, mica or plastic.

33. The method of claim 28 wherein the microwave source comprises a phased array microwave antenna.

34. The method of claim 28 wherein the microwave-inducible constituent is selected from the group consisting of O, H, and N.

35. The method of claim 28 wherein the at least one activated species is part of a plasma generated from the microwave radiation.

36. The method of claim 28 wherein:

the microwave-inducible constituent is selected from the group consisting of O, H, and N;

the deposited component comprises fragment of the precursor, but not an entirety of the precursor; and

the fragment is formed when the at least one activated species reacts with the at least one precursor.

37. The method of claim 28 wherein the microwave source extends across an expanse and generates microwaves along the expanse, the microwaves along one portion of the expanse being selectively tuned relative to the microwaves along a different portion of the expanse.

38. The method of claim 28 wherein the microwave source extends across an expanse and generates microwaves along the expanse, the microwaves along one portion of the expanse being selectively tuned relative to the microwaves along a different portion of the expanse; and wherein the tuned microwaves form a band of radiation which sweeps across a surface of the substrate during the depositing.

39. A deposition method, comprising:

providing an apparatus comprising a reaction chamber; a microwave source external to the chamber, and an inlet port extending through the microwave source and into the reaction chamber; the reaction chamber comprising a window through which microwave radiation can pass, and the inlet port extending through the window and terminating in an opening under the window; the apparatus further comprising a gas dispersion plate beneath the opening;

passing microwaves from the source, through the window, through the dispersion plate, and into the chamber;

placing a substrate within the reaction chamber and under the dispersion plate;

flowing one or more materials through the inlet port, across and through the dispersion plate, and into the reaction chamber; the one or more materials being subjected to the microwaves while in the reaction chamber; and

depositing at least a component of the one or more materials onto the substrate.

40. The deposition method of claim 39 wherein the window comprises quartz, mica or plastic.

41. The deposition method of claim 39 wherein the window consists essentially of quartz.

42. The deposition method of claim 39 wherein the gas dispersion plate comprises quartz, mica or plastic; and has a plurality of openings extending therethrough.

43. The deposition method of claim 39 wherein the gas dispersion plate consists essentially of quartz having a plurality of openings extending therethrough.

44. The deposition method of claim 39 wherein the window and gas dispersion plate consist essentially of quartz.

45. The deposition method of claim 39 wherein the microwave source comprises a phased array antenna.

46. The deposition method of claim 39 wherein the microwave source extends across an expanse and generates microwaves along the expanse, the microwaves along one portion of the expanse being selectively tuned relative to the microwaves along a different portion of the expanse.

47. The deposition method of claim 39 wherein the microwave source extends across an expanse and generates microwaves along the expanse, the microwaves along one portion of the expanse being selectively tuned relative to the microwaves along a different portion of the expanse; and wherein the tuned microwaves form a band of radiation which sweeps across a surface of the substrate during the depositing.

48. A deposition apparatus, comprising:

a reaction chamber;

a microwave source external to the chamber and configured to direct microwave radiation toward the chamber; and

a window in a side of the reaction chamber through which microwave radiation from the microwave source can pass into the chamber.

49. The apparatus of claim 48 further comprising a substrate holder within the chamber.

50. The apparatus of claim 49 wherein the substrate holder is in a path of the radiation.

51. The apparatus of claim 49 wherein the substrate holder is configured to regulate a temperature of a substrate held thereby.

52. The apparatus of claim 49 wherein the substrate holder includes a heater for heating a substrate held thereby.

53. The apparatus of claim 49 wherein the substrate holder is configured to retain a semiconductive material wafer within the reaction chamber, and wherein the microwave source is configured to emit a phased array of microwave radiation into the chamber and across an entire surface of a semiconductive material wafer retained within the chamber.

54. The apparatus of claim 49 wherein the substrate holder is configured to retain a semiconductive material wafer within the reaction chamber, and wherein the microwave source is a phased array antenna which extends across an entirety of a semiconductive material wafer retained within the chamber.

55. The apparatus of claim 48 wherein the window comprises quartz, mica or plastic.

56. The apparatus of claim 48 wherein the window consists essentially of quartz.

57. The apparatus of claim 48 wherein the microwave source is configured to emit a phased array of microwave radiation into the chamber.

58. A deposition apparatus, comprising:

a reaction chamber comprising a window;

a microwave source external to the chamber and configured to emit microwave radiation through the window and into the reaction chamber;

an inlet port extending through the microwave source and into the reaction chamber; the inlet port extending through the window and terminating in an opening under the window;

a gas dispersion plate within the reaction chamber and beneath the opening of the inlet port; and

a substrate holder within the chamber and beneath the gas dispersion plate.

59. The apparatus of claim 58 wherein the substrate holder is configured to regulate a temperature of a substrate held thereby.

60. The apparatus of claim 58 wherein the substrate holder includes a heater for heating a substrate held thereby.

61. The apparatus of claim 58 wherein the window comprises quartz, mica or plastic.

62. The apparatus of claim 58 wherein the window consists essentially of quartz.

63. The apparatus of claim 58 wherein the gas dispersion plate comprises quartz, mica or plastic; and has a plurality of openings extending therethrough.

64. The apparatus of claim 58 wherein the gas dispersion plate consists essentially of quartz having a plurality of openings extending therethrough.

65. The apparatus of claim 58 wherein the window and gas dispersion plate consist essentially of quartz.

66. The apparatus of claim 58 wherein the microwave source is configured to emit a phased array of microwave radiation into the chamber.

67. The apparatus of claim 58 wherein the substrate holder is configured to retain a semiconductive material wafer within the reaction chamber, and wherein the microwave source is configured to emit a phased array of microwave radiation into the chamber and across an entire surface of a semiconductive material wafer retained within the chamber.

68. The apparatus of claim 58 wherein the substrate holder is configured to retain a semiconductive material wafer within the reaction chamber, and wherein the microwave source is a phased array antenna which extends across an entirety of a semiconductive material wafer retained within the chamber.